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Published in:
European Economic Review

Publication date:
1995

Citation for published version (APA):
van Ours, J. C., & Ridder, G. (1995). Job matching and job competition: Are lower educated workers at the back of job queues? *European Economic Review*, *39*(9), 1717-1731.

ELSEVIER European Economic Review 39 (1995) 1717–1731

EUROPEAN ECONOMIC REVIEW

Job matching and job competition: Are lower educated workers at the back of job queues?

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Received January 1994; final version received December 1994

Abstract

During the cyclical downturn of the 1980s unemployment in the Netherlands increased substantially, with unemployment rates of lower educated workers increasing more than those of higher educated workers. A possible explanation of this phenomenon is job competition between workers with different levels of education. Another explanation of the diverging unemployment rates is that employers dismiss replaceable lower educated workers before irreplaceable higher educated workers. In this paper we scrutinize the job competition explanation. Our results show that there only is job competition between unemployed workers with an academic and a higher vocational education. There is no job competition at lower levels of education.

JEL classification: J63; J64; C13

Keywords: Job competition; Matching function; Unemployment; Vacancies

1. Introduction

During the cyclical downturn of the 1980s unemployment in the Netherlands increased substantially, with unemployment rates of lower educated workers increasing more than those of higher educated workers (see Fig. 1). A possible

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0014-2921/95/$09.50
SSDI 0014-2921(95)00010-0

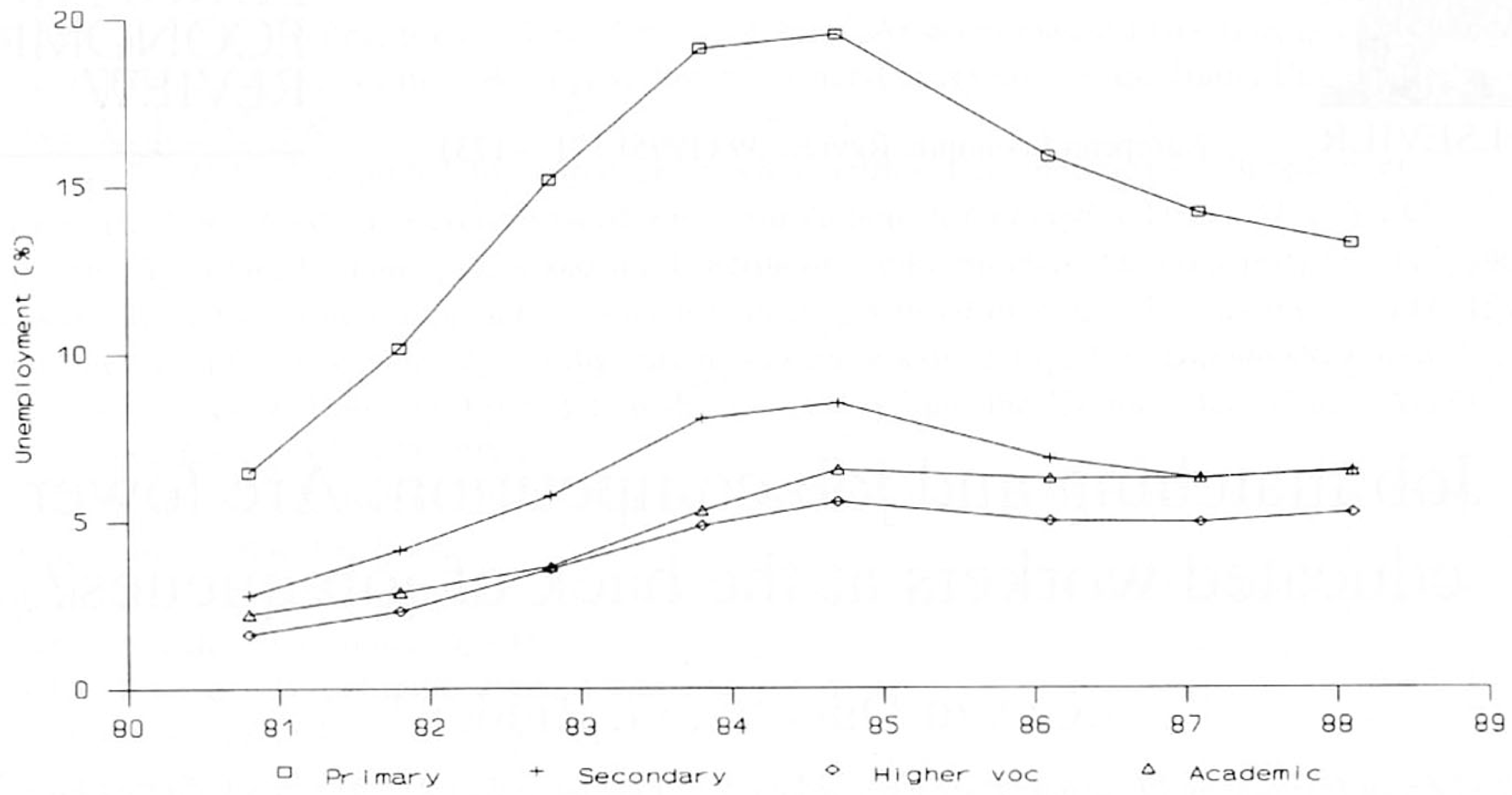

Fig. 1. Unemployment by educational level (% of the labour force at the relevant level).

explanation of this phenomenon is job competition between workers with different levels of education. If employment decreases lower educated workers compete for scarce jobs with higher educated workers. This competition may be caused by employers, who raise their hiring standards in periods of high unemployment (Okun, 1981), but even if hiring standards are constant over the cycle higher educated workers may be in the front of the job queues for scarce jobs (Thurow, 1975). In both cases, higher educated workers will take the jobs previously occupied by lower educated workers.

Job competition occurs during the transition from unemployment to a job, i.e. it is associated with flows in the labour market. Job competition by educational level – if existent – is a major problem from a policy point of view. If it exists, schooling of unemployed workers is ineffective leading only to a redistribution of unemployment. Unfortunately, there is hardly any empirical research on the topic of job competition. The reasons for this are twofold. First, there is no obvious theoretical framework applicable to empirical research. Second, the necessary flow data are difficult to obtain.

Our paper contributes to the limited empirical evidence on job competition. We present a new approach using a suitable theoretical framework, that of the matching function. Nevertheless our contribution is mainly empirical. We scrutinize the job competition explanation of the negative relationship between unemployment and the level of education by analyzing matching by educational level for the Dutch labour market of the 1980s. We estimate matching functions to investigate whether workers with a higher level of education competed successfully for jobs at a lower level of education. Our results show that there is only job competition between workers with an academic and a higher vocational education, while there is no job competition at lower levels of education. This is in line with the prediction of a simple theoretical model that we develop.

This result does not answer the question why unemployment rates diverge during a cyclical downturn and as Fig. 1 shows, converge again during an upturn. Although this question can not be answered satisfactorily in the present article, we shall point at some evidence that during a downturn employers dismiss workers by educational level. If workers with a higher level of education perform specialized tasks, that require specific skills, then employers will hang on to such irreplaceable workers during a downturn. On the other hand, lower educated workers may be easier to replace, so that the burden of adjustment is shifted to them.

This too has policy implications. If employers hang on to better educated workers, then schooling may reduce the cyclical variation in employment, and thereby decrease the average unemployment rate.

The paper is organized as follows. In Section 2 we discuss the phenomenon of job competition. Section 3 presents a model of job competition by educational level. We hypothesize that the choice of a worker to search for a job at a lower educational level depends on the wage and the expected duration of unemployment at both educational levels. Section 4 discusses the data that we use in the analysis and gives the estimation results. Section 5 concludes.

2. Job competition

As has been noted many times before, lower educated workers have higher unemployment rates than higher educated workers, and the difference increases in periods of high unemployment.

One explanation of this phenomenon is job competition between unemployed workers with different levels of education. Job competition occurs if employers prefer higher over lower educated workers for jobs that were previously occupied by lower educated workers. A necessary condition for this is, that employers can choose between workers, i.e. that there is a pool of applicants for a job. In Van Ours and Ridder (1992) we show that employers select a suitable candidate from such a pool of applicants. Although this is the normal search strategy used by employers in filling vacancies, efficiency wage arguments (e.g. Yellen, 1984) that imply that employers pay wages above the market clearing level, have been used to argue that job queues exist and do not lead to a downward adjustment of wages.

If unemployment increases and, as a consequence job queues lengthen, employers may react by increasing the hiring standards, e.g. the required level of education. As argued by Okun (1981), this may be an attractive strategy for employers who find it difficult to lower wages in times of high unemployment. Using the data that are discussed in Section 4, we have computed the average required level of education of new job vacancies during the 1980s. The results in Fig. 2 show that for the four occupational categories of Section 4 there is no

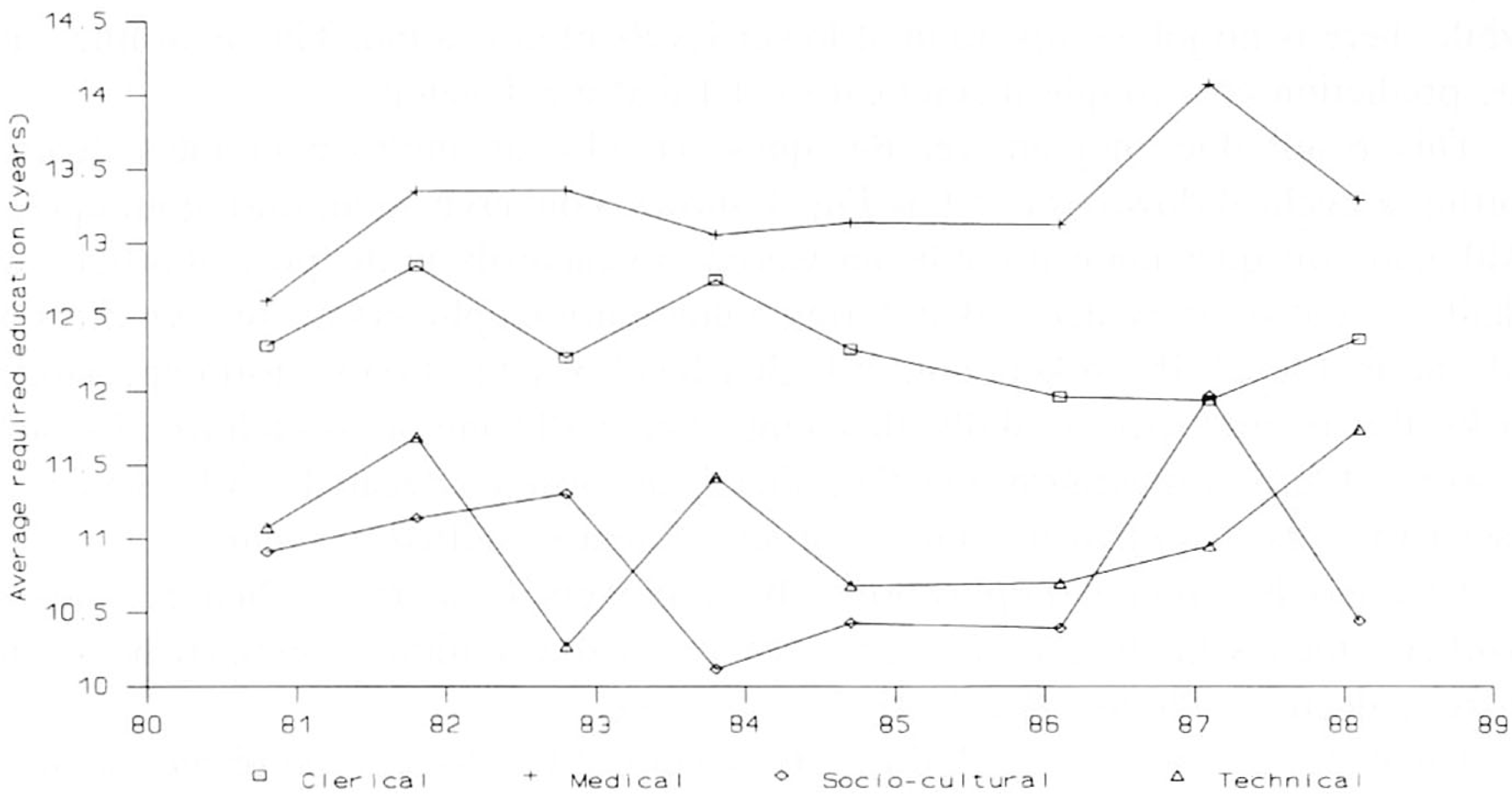

Fig. 2. Average required educational level for new job vacancies; 1980–1988.

Note: Calculations of the average level based on the assumption that: primary education = 9; years secondary = 12 years; higher vocational = 15 years; academic = 18 years.

evidence that the required educational level (measured in years of schooling) has increased with the level of unemployment. [1]

Even if the required level of education does not change over the cycle, longer job queues for scarce jobs may put lower educated workers at a disadvantage. This viewpoint has been strongly argued by Thurow (1975). According to Thurow the traditional wage competition labour market model is incorrect. In this model wages are flexible and therefore competition between workers eventually clears the labour market. In Thurow's view wages are fixed by collective bargaining. Productivity is a characteristic of jobs, not of individual workers. Education per se does not raise productivity but it is a sign of trainability. Potential workers are ranked in a queue according to their relative trainability for the available jobs. If, in times of recession, unemployment increases and the job queue lengthens, the workers at the back of the queue are not hired. Thus lower educated workers are hit the hardest by a recession.

[1] A simple regression of the average required educational level $E_{j,t}$, on the unemployment rate, $U_{j,t}$, a set of occupational dummies (technical is the reference group), and a time trend confirms this (t-values, 32 observations):

$$\underset{(26.2)}{E_{j,t} = 11.6} \underset{(1.5)}{- 0.47\, U_{j,t}} \underset{(3.3)}{+ 1.57\, d_{\text{medical}}} \underset{(2.5)}{+ 0.89\, d_{\text{clerical}}} \underset{(1.6)}{- 0.49\, d_{\text{sol-cult}}} \underset{(0.8)}{+ 0.03\, t}$$

where E is the average educational level of new vacancies, U is the number of unemployed, d is a dummy for occupational category, j is an index for occupational category ($j = 1, \ldots, 4$) and t is an index for time (1980–1988).

For an explanation of the relative increase of the unemployment rate of lower educated workers during a cyclical downturn we do not need an appeal to some form of job competition. A competing explanation starts from the well-documented difference in adjustment costs for skilled and unskilled workers (see e.g. Nickell (1986, Section 2); in a recent study Pfann and Palm (1990) find that the adjustment costs are 50% larger for white-collar workers). Because skill and the required level of education are highly correlated, we expect that the direct and indirect, i.e. due to lost investment in the employee, adjustment costs increase sharply with the educational level. As a consequence, the adjustment of the employment of higher educated workers will be much slower than that of lower educated workers. Hence, during a cyclical downturn lower educated workers will be dismissed before higher educated workers, and this order will result in a relatively high unemployment rate of lower educated workers.

Note that differential adjustment costs and job competition both explain the relatively high unemployment rate of lower educated workers. However, in the job competition theory the cause is a decline in the share of lower educated workers in the flow of new hires, while in the differential adjustment cost explanation the cause is an increase in the share of lower educated workers in the layoffs. To distinguish empirically between both explanations we require information on the composition of the flows of new hires and layoffs.

Teulings and Koopmanschap (1989) have related the change in the distribution of employment over educational levels for a number of labour markets distinguished by occupation and region to the change in the unemployment rate at the various levels of education in regional labour markets. As the change in the employment share of a particular level of education in a particular submarket is approximately proportional to the change in the relative unemployment rate at the relevant level in that submarket, the positive association that is found by Teulings and Koopmanschap is only a confirmation of the divergence of the unemployment rates by educational level as documented in Fig. 1. Teulings and Koopmanschap consider this positive correlation as evidence for job competition. We have argued that the same correlation can be explained by differential adjustment costs. In Section 4 we estimate the effect of an increase in unemployment at a particular level of education on the flow of new hires at a lower level of education. This gives a direct estimate of the degree of job competition.

3. Matching unemployment and vacancies

Job competition between workers of different educational levels may occur if an unemployed worker is better off searching at a lower level of education. We develop a stylized model that yields verifiable conditions for the occurrence of job competition. To obtain simple conditions we need to make a number of simplifying assumptions which do not hold in our data. To avoid a bias in our test of the job competition hypothesis we do not rely on the stylized model in the empirical analysis.

Let us consider an unemployed worker with educational level i, who has to decide to search for a job at either educational level i or educational level $i-1$. We assume that if he searches for a job at level i he is part of the pool of unemployed workers who search for a job at level i. The wage for a job at educational level i is W_i and the search duration is T_i. If he searches for a job at level $i-1$ he is part of the pool of unemployed workers searching for jobs at level $i-1$, with wage W_{i-1} ($W_{i-1} < W_i$) and a search duration of T_{i-1}. The unemployed worker receives unemployment benefits at rate B. Furthermore, we assume that accepted jobs last forever.

The discounted value of search for a job at level i is equal to

$$\int_0^{T_i} B\mathrm{e}^{-rt}\mathrm{d}t + \int_{T_i}^{\infty} W_i\mathrm{e}^{-rt}\mathrm{d}t, \tag{1}$$

which we can write as

$$B/r + \left[(W_i - B)/r\right]\mathrm{e}^{-rT_i}. \tag{2}$$

Assuming that the duration of search is exponentially distributed with hazard rate θ_i, the value of search at level i is

$$VS_i = B/r + (W_i - B).\theta_i/\left[r.(r+\theta_i)\right]. \tag{3}$$

In the same way we can derive the value of search at level $i-1$:

$$VS_{i-1} = B/r + (W_{i-1} - B).\theta_{i-1}/\left[r.(r+\theta_{i-1})\right]. \tag{4}$$

An unemployed worker at level i is indifferent between searching at level i or at level $i-1$ if $VS_i = VS_{i-1}$. Using (3) and (4) this means that this worker is indifferent if

$$\theta_i/\theta_{i-1} = (W_{i-1} - B)/\left[(W_i - B) + (W_i - W_{i-1}).\theta_{i-1}/r\right]. \tag{5}$$

In (5) the ratio of the search hazards is equal to the ratio of the return to employment at level $i-1$ and the sum of the return to employment at level i and the expected yield of searching at level i rather than at level $i-1$.

Note that since $W_{i-1} < W_i$, Eq. (5) states that in an equilibrium with search at level $i-1$, $\theta_i < \theta_{i-1}$. So an equilibrium situation with search at level $i-1$ by unemployed workers at level i requires the average search duration at level i to be longer than that at level $i-1$. Furthermore it follows that the larger the wage differential between the educational levels, the larger the difference between the average search durations must be.

The search duration at the different educational levels is influenced by the decision to search at a lower level. The search duration of an individual worker at level i will depend on both the number of unemployed workers that search at that level and on the number of vacancies at that level: the more unemployed workers search at level i, the longer the expected search duration for an individual worker, and the more vacancies at level i the shorter the expected search duration for an individual worker. To formalize this we use a matching function, which specifies the flow of filled job vacancies as a function of the number of unemployed workers and the number of vacancies. We specify the matching function as a constant returns to scale Cobb–Douglas function:

$$F = k.U^{\alpha}.V^{1-\alpha} \tag{6}$$

in which F = flow of filled job vacancies, U = unemployment, V = vacancies, k = efficiency parameter and α = parameter.

Matching functions as in (6) have been estimated using time series data for different countries. Blanchard and Diamond (1989) use American data, Jackman et al. (1989) use British data and Van Ours (1991) uses Dutch data.

In this study we specify a matching function for each educational level. If λ_i is the fraction of unemployed workers at level i that searches at level $i-1$, we may specify (6) for both educational levels as

$$\begin{aligned} F_i &= k.[(1-\lambda_i).U_i]^{\alpha}.[V_i]^{1-\alpha}, \\ F_{i-1} &= k.[U_{i-1}+\lambda_i.U_i]^{\alpha}.[V_{i-1}]^{1-\alpha}. \end{aligned} \tag{7}$$

In a steady state the hazard rate θ_i of the search duration of the unemployed workers at level i is equal to the ratio of the flow F_i and the stock of unemployed workers who search at level i.

Therefore

$$\begin{aligned} \theta_i &= k.[\{(1-\lambda_i).U_i\}/V_i]^{\alpha-1}, \\ \theta_{i-1} &= k.[\{U_{i-1}+\lambda_i.U_i\}/V_{i-1}]^{\alpha-1}. \end{aligned} \tag{8}$$

We define

$$\Phi = \{(W_{i-1}-B)/[(W_i-B)+(W_i-W_{i-1}).\theta_{i-1}/r]\}^{1/(1-\alpha)}. \tag{9}$$

Note that since $W_{i-1} < W_i$ it follows that $0 < \Phi < 1$. Using (5) and (8)–(9) we find that λ_i satisfies

$$\{U_{i-1}+\lambda_i.U_i\}/V_{i-1} = \Phi.(1-\lambda_i).U_i/V_i \tag{10}$$

from which we derive

$$\lambda_i = [\Phi.U_iV_{i-1} - U_{i-1}V_i]/[\Phi.U_iV_{i-1} + U_iV_i]. \tag{11}$$

There is job competition at level $i-1$ if $\lambda_i > 0$, so if

$$U_i/V_i > (1/\Phi).U_{i-1}/V_{i-1}. \tag{12}$$

If the wages at levels i and $i-1$ are the same, the condition for workers of level i to search at level $i-1$ is that the UV ratio at level i is larger than the UV ratio at level $i-1$. In other words: if wages at both levels are equal workers of

Table 1
Average difference in unemployment–vacancy ratio between educational levels; 1980–1988 [a]

Occupational category	$U_i / V_i - U_{i-1} / V_{i-1}$		
	$i = 2$	$i = 3$	$i = 4$
Technical	−16.0	−10.8	1.6
Medical	–	−1.8	4.0
Socio-cultural	−16.7	−1.8	19.9
Clerical	−8.2	−8.2	1.0

[a] i = level of education; 1 = primary, 2 = secondary, 3 = higher vocational, 4 = academic.

level i search at level $i-1$ until the UV ratios at both levels are equal. If $W_{i-1} < W_i$ a necessary but not sufficient condition for an unemployed worker at level i to search below his educational level is that the UV-ratio is lower at the lower level of education.

Before we check whether this necessary condition holds in our data, we must stress that its derivation relies on a number of counterfactual assumptions. Jobs are not held forever, and hence there are employed job seekers. [2] The steady-state assumption that allowed us to express the search duration hazard as the ratio of the vacancy flow and the stock of unemployed job seekers is not satisfied. We can model deviations between the expected search duration and the ratio of the vacancy flow and the stock of seekers by multiplicative shocks ϵ_i, ϵ_{i-1} to the parameter k, as we do in our empirical model in Section 4. These shocks may differ between educational levels, and hence Φ must be multiplied by $(\epsilon_{i-1}/\epsilon_i)^{1/(\alpha-1)}$. This factor may be greater than 1. Hence, although the necessary condition may be relevant on average, it may not be necessary in particular years.

Table 1 gives the average differences in UV ratios between educational levels for four occupational categories. For unemployed workers with an academic education the necessary condition for job competition is satisfied. For all other workers the necessary condition is not satisfied. As these conclusions have been derived from a stylized model they must be tested with data on flows of new hires. This test is performed in the next section.

4. Data and empirical analysis

The data used in the analysis are from eight vacancy surveys conducted by the Dutch Central Bureau of Statistics (CBS). These surveys were held in the months October 1980–1983, September 1984 and January 1986–1988. The vacancy

[2] It is very common that employed job seekers are ignored in matching models because of the mathematical complications. Only very recently (Pissarides, 1994) employed job search has been introduced in the context of a matching function.

survey is a stratified random sample in which data are collected of some 20,000 employers. The stratification is by size of establishment and by industry. Government agencies (central and local), educational institutions and temporary employment agencies are excluded from the survey. The employers in the surveyed population account for 80–85% of total employment.

From the surveys we obtained the number of job vacancies and their duration distinguished by level of education and occupational category. We distinguish between four levels of education (average years of schooling is given in parentheses): primary (9), secondary (12), higher vocational (15) and academic (18) and four occupational categories: clerical, technical, medical and (socio) cultural. [3] The incomplete duration was recorded in intervals: 0–1, 1–3, 3–6 and 6 + months. We used the grouped duration data to estimate Proportional Hazard models (see Van Ours and Ridder, 1991). From the estimates we computed expected completed durations. Next we obtained the flows of filled job vacancies by dividing the number of vacancies by the average completed vacancy durations. [4] The numbers of unemployed workers distinguished by level of education and occupational category were obtained from the Dutch Central Planning Bureau (CPB). [5]

Our dataset contains a limited number of observations in time. However, as shown in Fig. 1 the total time period covers eight years, with large fluctuations in the number of unemployed. If there has been a period in time during which one could find evidence for job competition by educational level, this is the period.

The empirical analysis starts from the matching functions in (7). In that equation job competition occurs if and only if $\lambda_i > 0$. Hence, we test directly for the existence of job competition without reliance on the condition in (12). In (7) a fraction λ_i of the unemployed at level i searches at level $i-1$. This is one of many possibilities. For instance, the fraction λ_i of the unemployed at level i may search both at level i and level $i-1$. For that reason our initial model is a general model which allows for all possibilities. All types of job competition can be

[3] To clarify the nature of the classification we give some examples: *Technical* (CBS classification: 3): Architect, engineer, plumber, painter, welder. *Medical* (5): Physician, medical receptionist, mid-wife, physio-therapist, pharmacist. *Clerical* (6): Economist, secretary, typist, salesman. *(Socio-) Cultural* (7 and 8): Social worker, personnel officer, waiter/waitress, artist, barber. Note that there are no medical workers at the primary level, so we distinguish 15 categories of vacancies.

[4] Of course, these computed flows are only correct if the number of vacancies is approximately constant over time, which is obviously not true. However, because the inflow and outflow rates are large relative to the stock of vacancies, equilibrium is quickly re-established after shocks to either the inflow or the outflow rate. Direct estimates of the in- or outflow rates are difficult to obtain.

[5] As will be discussed in Section 4 for Instrumental Variable estimates we use lagged information. Therefore, our empirical analysis concerns the period October 1981 – January 1988 and our dataset contains 105 observations (7 years and 15 categories of vacancies). The unemployment data of the CPB are quarterly data. We used the data from the third quarters of 1981–1984 and the fourth quarters of 1985–1987.

obtained by imposing parametric restrictions on the general model. The general model is:

$$F_{ijt} = \exp(\beta_0 + \beta_j d_j + \epsilon_{ijt}).(\lambda_{i1}U_{1jt} + \lambda_{i2}.U_{2jt} + \lambda_{i3}U_{3jt} + \lambda_{i4}.U_{4jt})^{\alpha}$$

$$.V_{ijt}^{1-\alpha}, \quad i=1,\dots,4,\ j=1,\dots,4. \tag{13}$$

In (13) the d_j are dummy variables for the occupational categories (technical occupations are the reference category). We assume that the efficiency of the labour market does not depend on the educational level. The equation allows for differences in efficiency between occupational categories. The error terms ϵ_{ijt} are interpreted as random shocks to the matching efficiency and are assumed to be uncorrelated over time.

In this general model which we label Model 1, the flow of vacancies at level i depends on the number of unemployed at all educational levels. This model allows for all types of job competition, including upward competition (the unemployed of level i search at level $i+1$) and competition at more than one level downward (the unemployed of level i search at level $i-2$). We normalize the λ_{ij}'s by setting $\lambda_{11} = 1$. After taking logarithms we pool the equations in (13) and estimate Model 1 by Non-Linear Least Squares. [6] The hypotheses on the nature of job competition can be formulated as restrictions on the general Model 1. An overview of these restrictions is given in Table 2.

In Model 2 the flow of new hires at some level depends only on the number of unemployed at the same educational level or one level below. The Likelihood Ratio (LR) test that is also reported in Table 2 does not reject the restrictions. Hence, we conclude that job competition between educational levels can be restricted to downward competition at one level below the level of the flow of new hires.

If we restrict job competition to one level below the level of the flow of new hires then we can ask whether the unemployed of level i that search at level $i-1$ only search at level $i-1$ or whether they simultaneously search at level i. The corresponding models are Model 3 (no simultaneous search) and Model 4 (simultaneous search). The parameter restrictions are again given in Table 2.

From the LR tests we conclude that the restrictions embodied in Model 4 are rejected while these embodied in Model 3 are not rejected.

As a final check we estimate a model that does not allow for job competition (Model 5). The LR test clearly rejects this model against Model 3. We conclude that there is job competition at at least one educational level.

To answer the question at which educational levels there is job competition we consider the parameter estimates of Model 3, the model that is not rejected by the

[6] In the estimation we impose the restriction that the λ-parameters are greater than or equal to zero.

Table 2
Parameter restrictions in models of job competition [a]

	Model 1	Model 2	Model 3	Model 4	Model 5
λ_{11}	1	1	1	1	1
λ_{12}	.	.	λ_2	λ_2	0
λ_{13}	.	0	0	0	0
λ_{14}	.	0	0	0	0
λ_{21}	.	0	0	0	0
λ_{22}	.	.	$1-\lambda_2$	1	1
λ_{23}	.	.	λ_3	λ_3	0
λ_{24}	.	0	0	0	0
λ_{31}	.	0	0	0	0
λ_{32}	.	0	0	0	0
λ_{33}	.	.	$1-\lambda_3$	1	1
λ_{34}	.	.	λ_4	λ_4	0
λ_{41}	.	0	0	0	0
λ_{42}	.	0	0	0	0
λ_{43}	.	0	0	0	0
λ_{44}	.	.	$1-\lambda_4$	1	1
Restrictions	0	9	12	12	15
RSS	15.01	15.78	16.81	18.12	19.05

Likelihood ratio tests (degrees of freedom) [b]	
Model 1–Model 2:	5.3 (9)
Model 2–Model 3:	6.6 (3)
Model 3–Model 5:	13.1 (3) *
Model 2–Model 4:	14.5 (3) *
Model 4–Model 5:	5.3 (3)

[a] . Indicates that the parameter is not restricted; besides the λ-parameters the model contains 5 parameters; *RSS* = residual sum of squares.
[b] Likelihood Ratio test = 105 (log *RRSS*–log *URSS*), in which *RRSS* = restricted residual sum of squares, *URSS* = unrestricted residual sum of squares; * = significant at 5%-level; Critical χ^2-values: $\chi^2(9) = 16.9$; $\chi^2(3) = 7.8$.

LR test. These estimates are shown in the first column of Table 3. [7] The data are informative as can be seen from the standard errors of the estimates: the number of observations is small, but not too small to obtain rather precise estimates. It appears that the market for technical workers has the lowest efficiency, while that for medical workers has the highest. The efficiency of the market for clerical and socio-cultural workers is about the same. The parameter α of the matching function is about 0.3.

There are differences between the estimates of the job competition parameter at the various levels. This parameter is not significant at the primary and secondary

[7] Because the observations refer to time intervals of different lengths, testing for serial correlation is not straightforward. Inspection of the residuals did not point at serial correlation.

Table 3
Estimation results: Job competition by educational level[a]

	Model 3 NLS	Model 3 NLS	Model 3 IV	Model 3 NLS	Model 3 and (14) NLS
Constant	−1.00 (6.7)	−1.05 (8.8)	−1.12 (4.6)	−1.19 (6.3)	−1.09 (9.1)
β medical	0.89 (7.4)	0.89 (7.4)	0.91 (7.3)	0.90 (7.3)	0.90 (7.5)
β clerical	0.54 (4.6)	0.56 (5.0)	0.57 (4.4)	0.56 (4.7)	0.57 (5.1)
β soc-cult	0.45 (3.6)	0.43 (3.5)	0.39 (2.6)	0.41 (3.1)	0.46 (3.7)
α	0.30 (6.0)	0.32 (7.2)	0.35 (3.8)	0.34 (5.4)	0.33 (7.5)
λ_2	0.16 (0.6)	–	0.08 (0.3)	0.05 (0.2)	–
λ_3	0.18 (0.5)	–	0.01 (0.0)	−0.04 (0.1)	–
λ_4	0.65 (4.7)	0.61 (5.1)	0.57 (3.0)	0.58 (3.9)	–
ϕ_0	–	–	–	–	0.07 (0.1)
ϕ_1	–	–	–	–	0.04 (1.8)
d82	–	–	–	−0.08 (0.5)	–
d83	–	–	–	0.10 (0.6)	–
d84	–	–	–	0.11 (0.7)	–
d86	–	–	–	0.16 (1.0)	–
d87	–	–	–	0.18 (1.2)	–
d88	–	–	–	0.15 (1.0)	–
$\bar{R}^2$	0.888	0.890	0.887	0.884	0.857
RSS	16.81	16.88	16.99	16.11	16.45

[a] NLS = Nonlinear Least Squares; IV = Instrumental Variables; *t*-values in parentheses; R^2 is corrected for degrees of freedom; *RSS* = residual sum of squares; *d82*,..., *d88* = dummy variables for the years 1982,..., 1988.

level. The parameter at the level of higher vocational education is significant, indicating job competition between workers with a higher vocational education and academically educated workers. In other words, job competition is restricted to the higher educational levels.

The second column of Table 3 shows the estimation results if we restrict $\lambda_2 = \lambda_3 = 0$. The LR test statistic is 0.67 with 2 degrees of freedom and this confirms that the restriction to the higher educational levels cannot be rejected.

We performed some sensitivity checks of the estimates of Model 3. Because F_{ijt} is obtained by dividing V_{ijt} by the average vacancy duration at level i in year t, we may question the exogeneity of V_{ijt}. To account for possible endogeneity of V_{ijt} we also computed Instrumental-Variable estimates for Model 3. As an instrument for the number of vacancies at the survey date t we used the vacancy inflow in year $t-1$. V_{ijt} consists of vacancies that were posted at some moment before the survey date and are still open at that date. Because almost all vacancies are filled within one year (Van Ours and Ridder, 1991) the lagged inflow is a valid instrument. The estimation results were obtained by Nonlinear 2SLS using a method developed by Amemiya (1974). The estimation results in the third column of Table 3 show that there is not much difference with the results obtained with NLS. We take this as evidence that endogeneity of V_{ijt} is not a serious problem.

As indicated before our model does not allow for search on the job. An important question is whether ignoring employed job seekers biases our estimation results. We cannot give a direct answer since we lack the necessary data. However, it is clear that employed job seekers who can fall back on their current job have less of an incentive to search below their current educational level. Hence, if the unemployed at the intermediate levels do not search at another level, it is unlikely that the employed job seekers do. Also note that if the total number of (employed and unemployed) job seekers is proportional to the number of unemployed job seekers our estimates are still valid, because the constant of proportionality is absorbed by the constant β_0. If the ratio of the employed to the unemployed job seekers changes over time then this can be captured by introducing time dummies in the multiplicative constant. The estimation results can be found in the fourth column of Table 3. The job competition parameters are virtually unchanged.

In Model 3 we assume that the job competition parameter λ_4 is constant over time. However, from our theoretical model in Section 3 we derive that this parameter depends on UV ratios of educational levels 3 and 4. Therefore, in the fifth column we specify the job competition parameter λ_4 as a function of the difference in UV-ratio at the academic and higher vocational level. As hypothesized in Section 3 λ_4 also depends on differences in wages at both levels, but we have no data on this. We specified λ_4 as

$$\lambda_4 = \exp(\phi_0 + \phi_1 \cdot (U_4/V_4 - U_3/V_3) \\ /\{1 + \exp(\phi_0 + \phi_1 \cdot (U_4/V_4 - U_3/V_3)\}. \tag{14}$$

The coefficient ϕ_1 does not differ significantly from zero, although it has the correct sign. As noted at the end of Section 3 nonstationarity may induce noise in the UV-ratios, and this measurement error may bias the estimate of ϕ_1 downward.

All in all the estimation results in Table 3 indicate that, except for the higher vocational level, there is no evidence of job competition. More precisely, only at the higher vocational level the flow of filled vacancies is affected by the level of unemployment at the next higher level of education. This result is consistent with the prediction of Table 1. However, an inspection of Fig. 1 does not lead to this conclusion: the unemployment rates of workers with a higher vocational and academic training do not diverge dramatically. The unemployment rates of workers with an education at the primary and secondary level do diverge dramatically and those for workers with a secondary and higher vocational training do so to a lesser extent. Therefore, it is no surprise that 'direct' estimates, as those obtained by Teulings and Koopmanschap, lead to the conclusion that there is job competition at these levels. As argued before, the interpretation of these 'direct' estimates is ambiguous, and our results, that provide a direct test of the presence of higher educated workers in queues for jobs that require only a lower level of education show that they are misleading: there is no evidence of job competition at the primary and secondary level, despite diverging unemployment rates.

5. Conclusion

With our results we reject the existence of job competition at lower, i.e. primary and secondary, levels of education. Moreover, we can explain why previous authors have concluded that job competition is important at these levels. The observation that unemployment rates diverge during a cyclical downturn is by itself not sufficient to prove the existence of job competition. A direct test of the crowding-out hypothesis must be based on a study of the composition of new hires over the cycle, and this is what our test does. Information on wages, in particular starting wages of new hires, would be very interesting, because it would allow us to see whether the 'wage competition model' gives a better description.

A possible explanation of the diverging unemployment rates during a cyclical downturn, is that employers dismiss replaceable lower educated workers before irreplaceable higher educated workers. For a test of this hypothesis we need data on the composition of the inflow into unemployment (from employment) over the cycle. In the Netherlands inflow data classified by level of education are not available, and even estimates based on unemployment durations by educational category can not be obtained. Related evidence for the UK and the USA is given by Layard et al. (1991, Table 3, p. 45), and this evidence shows that in 1984 and 1987 respectively the difference in unemployment rates between skill groups is due to differences in the inflow rate and not in the duration of unemployment. Of course, this evidence is only suggestive and not conclusive.

More insight into the reason why unemployment rates diverge is important, because the job competition and the differential adjustment cost hypotheses have radically different implications for the effectiveness of schooling. Schooling is ineffective and only leads to a redistribution of unemployment, if job competition is important. If however, because of high adjustment costs, employers hang on to better educated workers then schooling may reduce the cyclical variation in employment, and thereby decrease the average unemployment rate.

Acknowledgment

The authors would like to thank the editor and two anonymous referees for helpful comments. They also thank the Dutch Central Bureau of Statistics and the Dutch Central Planning Bureau for making the vacancy and unemployment data available to them.

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